

Market Forecasting Planning Model Based on Improved Neural Network

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Keywords: Listed enterprise evaluation; wavelet analysis singularity method; grey prediction; time series prediction

Abstract: In the case of China's growth-oriented technology innovation enterprise financing becomes a short-term, the domestic market is evaluated and forecasted by reference to the average market-selling rate of NASDAQ listed companies in the same type of market in the United States, and then the domestic market is evaluated. Planning. And the company's profit growth rate in the development stage is extremely fast, which leads to the traditional valuation method not applicable to the valuation of China's science and technology listed companies. At the same time, Kechuang Board provides a channel for financing SMEs in China, which is conducive to promoting the change of China's industrial structure, but the key to its development lies in the accurate valuation of listed companies. After processing the data by the wavelet analysis singularity method, the gray prediction model of the trend mobile neural network is used to predict the valuation level to more reasonably evaluate the listed company. Gray prediction and timing prediction are used according to the sub data type.

1. Introduction

P/E ratio (PE): A measure of the relationship between stock price and company profitability. Price-earnings ratio = stock price / earnings per share, earnings per share is the value of the company's income per share after the company deducts various costs, expenses, taxes, and interest.

Market-to-sales ratio (PS): The ratio of stock value to sales revenue per share. P/S ratio = share price per share / sales per share. For loss-making enterprises and light-asset enterprises, the price-earnings ratio is difficult to measure. Compared with the P/E ratio, the P/S ratio fluctuates less, and the sales are generally more realistic. For companies with more mature or cyclical valuation methods, the P/S ratio has important reference value, even if there is no profit. The new company can also calculate the market sales rate to value.

Fundamental refers to the analysis of the macroeconomic, industry and company basic conditions, including the company's business philosophy, company statements and so on. It includes the macroeconomic operation situation and the basic situation of listed companies. The macroeconomic operation situation reflects the overall operating performance of listed companies and also sets the background for the further development of listed companies. Therefore, the macro economy has a close relationship with listed companies and corresponding stock prices.

Liquidity refers to the ability of a bank to satisfy the depositor's withdrawal of cash, payment of debts and normal loans of the borrower. It is an indicator of the ability of assets to be liquidated. One of the principles of Western commercial banking business operations. The liquidity of a bank is generally determined by the ratio and structure of the bank's assets and liabilities.

2. Research methods

2.1 Valuation of the board of the company

The market-to-sales ratio (PS) is the ratio of the value of a stock to its sales per share. Compared with the P/E ratio, the P/S ratio fluctuates less, and the sales are generally more realistic. For companies with more mature or cyclical valuation methods, the P/S ratio has important reference

value, even if there is no profit. The new company can also calculate the market sales rate to value. P/S ratio (PS) = share price per share / sales per share. For loss-making enterprises and light-asset enterprises, the price-earnings ratio and the price-to-book ratio are difficult to measure. This is why many Internet startups value market share, traffic and data so much that there is no profit in burning money. Second, light assets operate, and it is not appropriate to use the price-earnings ratio and the price-to-book ratio to estimate.

However, there is also inaccuracy in the market-to-sales ratio. The main performance is that even if the company's sales revenue grows rapidly, the profit level may not change much. In addition, the market-to-sales ratio does not take into account the difference in cost structure between different companies.

The connotation mechanism of the market sales rate can be summarized into two points:

(1) The low market sales rate is more favorable. The size of the market-to-sales ratio is directly dependent on two variables: the market value of the business and the sales revenue. The market value of an enterprise is affected by the stock price. If the company's stock price change is caused by the good business performance of the company, it reflects that the company's stock price is consistent with its investment value. Sales revenue increased, and the market-to-sales ratio indicator decreased when the market value remained unchanged.

(2) The stability of the market sales rate is critical. From the side, the stability of the market-to-sales ratio can reflect that investors' views on the listed company remain at a wait-and-see stage or have sufficient confidence in the company. Combined with the value of the market-to-sales ratio, we can glimpse the attitude of investors. In addition, the stability of the denominator sales revenue can reflect the company's management level and profitability are relatively stable. In summary, the company's operating performance is low and the market performance is stable and the investment value is high.

The valuation premium and discount level are one aspect of the value of the stock. The issue premium of the stock represents the market's expectation of the stock and is a representative indicator of the company's development. Simply put, investors can consider the premium rate as one of the investment costs.

Wavelet analysis singularity method: The singular point (mutation point) of a signal often contains many key information of the signal. The wavelet transform is a further complete and extended based on the Fourier transform. It overcomes the shortcomings of the Fourier transform in observing the local time-frequency characteristics (only the overall properties of the signal singularity can be judged, and the mutation point cannot be specifically specified). The improvement not only has a good overall analysis capability of the waveform, but also has superior time-frequency domain localization analysis capability; when analyzing the time-frequency characteristics of the non-stationary signal, it is used at different positions in the time-frequency phase plane. Different windows (resolutions) can effectively obtain detailed information of the signal in the time domain and frequency domain. Therefore, the signal singular point decision method based on wavelet analysis is suitable for the identification and extraction of feature information such as edge singular points and peak singular points in non-stationary signals, which will be used in power system fault diagnosis, seismic data analysis, medical imaging, speech recognition, etc. Play an important role in the field of signal processing.

Let $h(t)$ be the convolution of the functions $f(t)$ and $g(t)$, namely:

$$h(t) = f(t) \otimes g(t)$$

According to the nature of the Fourier transform:

$$\begin{aligned} F[h'(t)] &= j\omega F[f(t) \otimes g(t)] = j\omega \hat{f}(\omega) \hat{g}(\omega) \\ &= [j\omega \hat{f}(\omega)] \hat{g}(\omega) = \hat{f}'(\omega) [j\omega \hat{g}(\omega)] \\ &= F[f'(t)] \otimes F[g(t)] = F[f(t)] \otimes F[g'(t)] \end{aligned}$$

So get:

$$h'(t) = f'(t) \otimes g(t) = f(t) \otimes g'(t)$$

If the function $f(t)$ is regarded as a signal and $g(t)$ is regarded as a filter, the convolution result of the derivative of the signal and the filter can be regarded as the convolution of the derivative of the filter with the signal. For example, if $g(t)$ is chosen as a Gaussian function, Morlet wavelet and Maar wavelet can be constructed by using its derivative. Therefore, the mutation point and extreme point of the wavelet transform correspond to the mutation point and extreme point of the signal $f(t)$. Relationship, using wavelets to detect abrupt signals. The specific process is as follows:

Set $\theta(t)$ as a smoothing low-pass stationary function and satisfy the condition

$$\int_{-\infty}^{\infty} \theta(t) dt = 1, \quad \lim_{|t| \rightarrow \infty} \theta(t) = 0$$

Usually taken $\theta(t)$ as a Gaussian function, ie

$$\theta(t) = \frac{1}{\sqrt{2\pi}} e^{-t^2/2}$$

Hypothesis $\theta(t)$ is secondary derivable and defined

$$\begin{aligned} \varphi^{(1)}(t) &= \frac{d\theta(t)}{dt} = -\frac{1}{\sqrt{2\pi}} t e^{-t^2/2} \\ \varphi^{(2)}(t) &= \frac{d^2\theta(t)}{dt^2} = \frac{1}{\sqrt{2\pi}} (1 - t^2) e^{-t^2/2} \end{aligned}$$

Then the $\varphi^{(1)}(t)$ 、 $\varphi^{(2)}(t)$ function satisfies the tolerance of the wavelet:

$$\int_{-\infty}^{\infty} \varphi^{(1)}(t) dt = \int_{-\infty}^{\infty} \varphi^{(2)}(t) dt = 0$$

Therefore, it can be used as a wavelet master function.

If it is recorded $\theta_s = \frac{1}{s} \theta(\frac{t}{s})$, $\theta_s(t)$ it means the expansion and contraction under the scale factor s . Since the wavelet transform is obtained by convolving the original signal $f(t)$ with the telescopic wavelet, the convolutional wavelet transform defined by the wavelet function is:

$$\begin{aligned} w_s^{(1)} f(t) &= f * \varphi_s^{(1)}(t) = f * \left(s \frac{d\theta_s}{dt} \right) (t) = s \frac{d}{dt} (f * \theta_s)(t) \\ w_s^{(2)} f(t) &= f * \varphi_s^{(2)}(t) = f * \left(s^2 \frac{d^2\theta_s}{dt^2} \right) (t) = s^2 \frac{d^2}{dt^2} (f * \theta_s)(t) \end{aligned}$$

It can be seen that the wavelet variation $w_s^{(1)} f(t)$ 、 $w_s^{(2)} f(t)$, respectively, $\theta_s(t)$ is that the function $f(t)$ takes the first-order and second-order derivatives after smoothing at the scale s . When s is small, the result of smoothing on $f(t)$ has little effect on the mutation position of $f(t)$: when s is large, the smoothing process will cut some small mutations of $f(t)$. Only the large size mutations remain.

From this we can see that when the wavelet function can be regarded as the n -th derivative of a certain smoothing function, the local extremum point of the signal wavelet transform module corresponds to the sudden change point (or edge) of the signal. When the wavelet function can be regarded as the order derivative of a certain smoothing function, the zero-crossing point of the signal wavelet transform module also corresponds to the sudden change point (or edge) of the signal. This is the principle of detecting the signal transition point (or edge) of the zero-crossing and local extremum points of the wavelet transform coefficient modulus.

In the process of modeling, in order to accurately model and solve the problem accurately, taking

into account the stability of the market-to-sales ratio, before the measurement of the 2018 valuation level, the "wavelet analysis singularity method" is used for each company 2009-2018. The annual sales rate data is checked, the company with abnormal data is excluded, and the valuation of the remaining companies is calculated (that is, the average of the 2018 sales rate of the company).

2.2 Solving and analyzing the model

According to calculations, the average market-to-sales ratio of China's A-share market (SSE stocks) in 2018 is 4.92. The average market-selling rate of the US NASDAQ market is 129.03. After calculating the valuation premium, the US NASDAQ market has a higher premium than China, indicating China's stock. The market has more potential.

2.3 Estimation of the valuation of the market in 2018

The process of quantitative analysis of the relationship between valuation indicators and fundamental indicators and liquidity indicators is a relatively complex nonlinear system. Such system equations are complex and difficult to model mathematically. In this case, we The BP neural network was chosen to express this nonlinear system. The method considers the location system as a black box. First, the BP neural network is trained with the system input and output data, so that the network can express the unknown function, and then use the trained BP neural network to predict the system output.

The BP neural network based nonlinear function fitting algorithm flow can be divided into three steps: BP neural network construction, BP neural network training and BP neural network prediction:

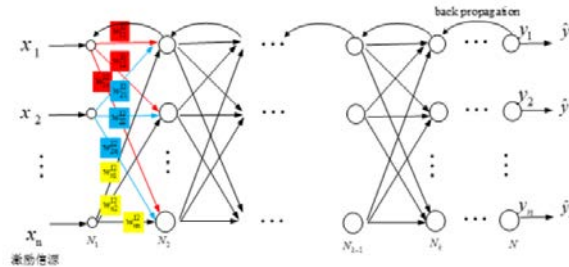


Fig.1 nonlinear function fitting algorithm flow

The basic principle of BP network model processing information is that the input signal X_i acts on the output node through the intermediate node (hidden layer point), and generates an output signal Y_k through non-linear transformation. Each sample of the network training includes the input vector X and The expected output t , the deviation between the network output value Y and the expected output value t , by adjusting the connection strength value W_{ij} of the input node and the hidden layer node and the connection strength T_{jk} between the hidden layer node and the output node and the threshold value, The error falls in the direction of the gradient. After repeated learning and training, the network parameters (weights and thresholds) corresponding to the minimum error are determined, and the training stops. At this time, the trained neural network can process the non-linear conversion information with the smallest output error for the input information of similar samples.

Neural Network Neurons: The following figure shows the j th basic BP neuron (node), which mimics only the three most basic and important functions of biological neurons: weighting, summation, and metastasis. Wherein $X_1, X_2, \dots, X_i, \dots, X_n$, respectively, represent inputs from neurons 1, 2, ... i, ... n; respectively, $w_{j1}, w_{j2}, \dots, w_{ji}, \dots, w_{jn}$ indicating the connection strength of neurons 1, 2, ... i, ... n and the j th neuron, that is, weights; b is Threshold; $f(\cdot)$ is the transfer function; is the output of the j th neuron.

The net input value S_j of the j th neuron is:

$$S_j = \sum_{i=1}^n w_{ji} * x_i + b_j = W_j X + b_j$$

among them:

$$X = [x_1 x_2 \cdots x_i \cdots x_n]^T W_j = [w_{j1} w_{j2} \cdots w_{ji} \cdots w_{jn}]$$

$$X = [x_0 x_1 x_2 \cdots x_i \cdots x_n]^T W_j = [w_{j0} w_{j1} w_{j2} \cdots w_{ji} \cdots w_{jn}]$$

$$S_j = \sum_{i=0}^n w_{ji} * x_i = W_j X$$

After the net input S_j passes the transfer function (TransferFunction) $f(\cdot)$, the output y_j of the j th neuron is obtained:

$$y_j = f(s_j) = f\left(\sum_{i=0}^n w_{ji} * x_i\right) = F(W_j X)$$

Where $f(\cdot)$ is a monotonically rising function and must be a bounded function, since the signal transmitted by the cell cannot be increased indefinitely and must have a maximum.

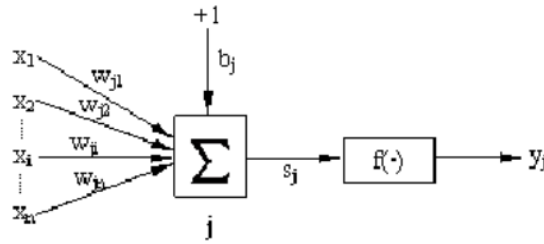


Fig.2 BP network model

2.4 Solving and analyzing the model

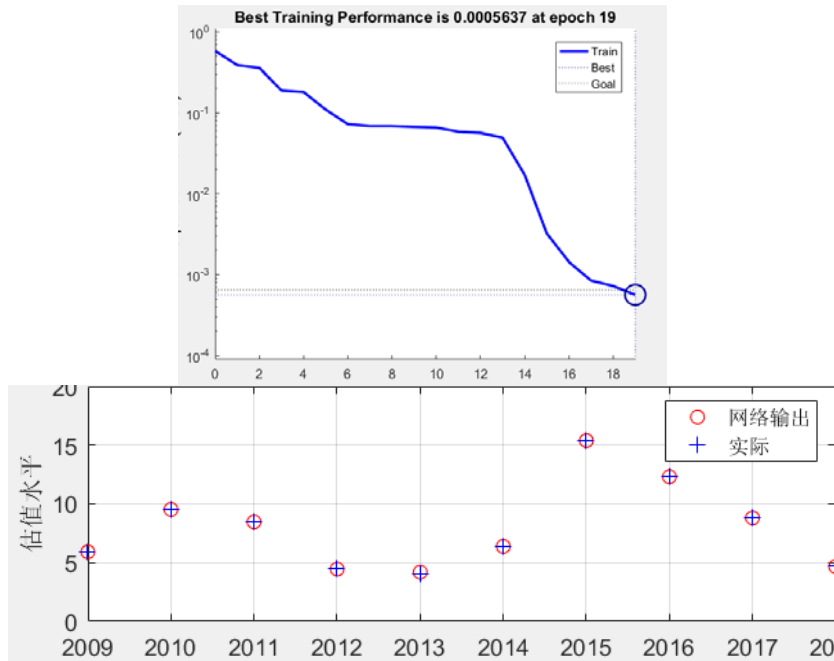


Fig. 3 China A-share market data fitting

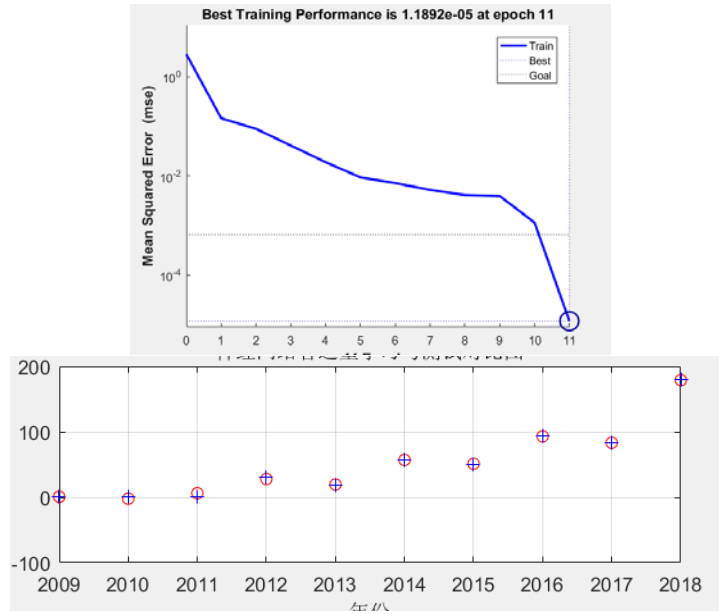


Fig 4 US market NASDAQ market data fitting

2.5 Grey Prediction Model for Trending Mobile Neural Networks

It is necessary to predict and analyze the fundamental indicators and liquidity indicators of China's A-share market and the US NASDAQ market in 2019. Same as the first problem, the data needs to be pre-processed before the forecast, and the trend moving method, the simple moving average method and the weighted moving average method are adopted for the basic index and the liquidity index.

When there is no obvious trend change in the time series, the simple moving average method and the weighted moving average method can accurately reflect the actual situation. However, when the time series shows a trend of increasing or decreasing the straight line, the simple moving average method and the weighted moving average method are used to predict the hysteresis deviation.

Therefore, it is necessary to make corrections. The correction method is to make a secondary moving average, and use the law of moving average hysteresis deviation to establish a prediction model of the linear trend.

The average number of translations is

$$M_t^{(1)} = (y_t + y_{t-1} + \dots + y_{t-N+1})/N$$

The average of the second translation is

$$M_t^{(2)} = \frac{M_t^{(1)} + M_{t-1}^{(1)} + \dots + M_{t-N+1}^{(1)}}{N} = (M_t^{(1)} - M_{t-N}^{(1)})$$

From question 2, there is a quantitative relationship between valuation indicators and fundamental indicators and liquidity indicators. Integrating predictive and historical indicators, BP neural network prediction first normalizes input and output, so that the value range is limited to [0 In 1], re-initialize the weight and threshold so that the initialization weight takes a random number between (-1, 1).

According to the improved BP neural network algorithm training network, in the network training process, the activation function between the input layer and the hidden layer, between the hidden layer and the output layer are Sigmoid functions: the hidden layer uses the tansig transfer function, the output The layer uses the logig transfer function, the learning rate η is 0.1, the momentum factor α is 0.8, the global error of the network is 0.001, and the maximum number of training steps is 1000, which is displayed every 10 steps.

The trial algorithm is used to determine the number of hidden layer nodes in the network, and the number of hidden nodes is changed when other parameters are unchanged, and the network prediction error when comparing the number of different hidden nodes is compared. In the case

where it is determined that the number of samples of the present example and the input node are unchanged, the number of nodes of the hidden layer is changed.

In order to improve the prediction accuracy better, the gray residual sequence is used, and the residual sequence value is corrected by the BP neural network. The trial algorithm is used to determine the number of hidden layer nodes. When the number of hidden layer nodes is 27, the effect is best.

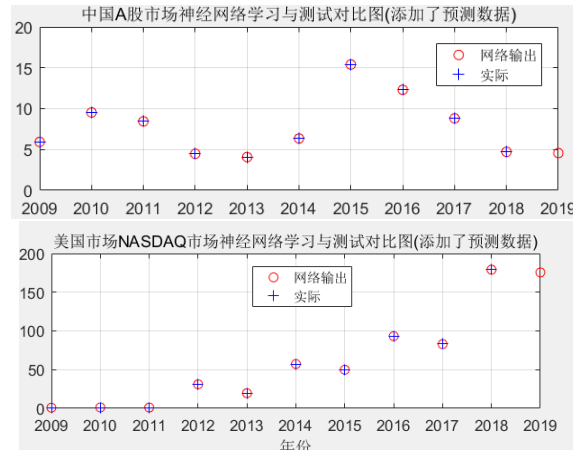


Fig.5 the trial algorithm result

3. Conclusion

3.1 Advantages

- (1) Make full use of the data in the attached table, and rationally screen the valid data by analyzing the data in the chart, which improves the accuracy of model establishment.
- (2) Using the combined neural network algorithm to confirm the relationship between the parameters and correcting with the gray model, the error is very small and reliable.
- (3) The model is universal and suitable for generalization to data trend prediction, power load forecasting and other fields.

3.2 Disadvantages

The modeling method is simpler. There are no multiple models for the same problem, and multiple methods cannot be analyzed and compared.

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